

8. Draw the image of the triangle so that line XY is the flip line.



61 55 52

Panel rating: satisfactory

This is a geometry question on motion that measures students' understanding of a flip image.

9. Place each of the numbers 1, 2, 3, 4, 5, and 6 in the circles so that the sum of the numbers on each side of the triangle is the same. Use each number only once.



44 71 50

Panel rating: satisfactory

For this non-routine problem, students must experiment with different combinations of numbers to find the one that satisfies the conditions.

The following questions do not have teacher predictions or panel ratings. The box below each question contains the percentage of correct responses.

#### Oral Questions

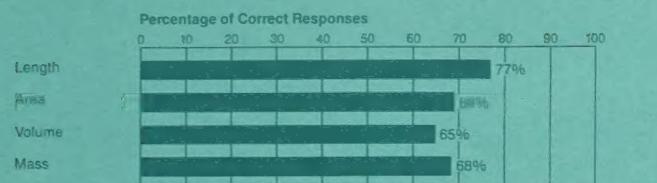
10.  $56 - 22 =$  \_\_\_\_\_

85

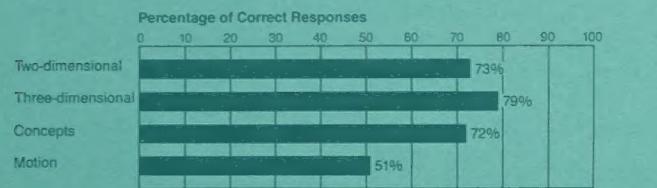
11. You have 27 cents. Your mother gave you 30 cents. How much more money do you need to buy an item costing 70 cents?

59

#### Student Achievement in Measurement by Topic



#### Student Achievement in Geometry by Topic



Interpretation panels consisting of educators and parents reviewed the test questions and the student-achievement results. Results were rated on a five-point scale: *superior*, *strong*, *satisfactory*, *marginal*, and *weak*. The panel ratings for each topic are given below:

##### 1. Arithmetic:

- numeration – *satisfactory*
- operations (whole numbers) – *strong*
- operations (decimals) – *satisfactory*
- operations (fractions) – *satisfactory*
- representation – *superior*

##### 2. Measurement:

- length – *satisfactory*
- area – *marginal*
- volume – *marginal*
- mass – *marginal*

##### 3. Geometry:

- two-dimensional – *satisfactory*
- three-dimensional – *strong*
- concepts – *marginal*
- motion – *marginal*

##### 4. Non-routine problems:

- *marginal*

#### Observation Tasks

Students were shown six pennies and asked to show one-half, one-third, and two-thirds of the pennies. Ninety-nine per cent, 75 per cent, and 72 per cent correctly identified one-half, one-third, and two-thirds, respectively.

Seventy-nine per cent of the students correctly measured the length of a string using a metre stick.

#### How do students feel about mathematics?

Sixty-one per cent of the students say they like mathematics, 60 per cent say they are good in mathematics, and only 15 per cent say that mathematics is difficult. More than 90 per cent of the students consider mathematics to be important for employment, equally important for boys and girls, and important in the eyes of their parents.

#### What kind of instruction do students receive in mathematics?

The most commonly used methods for teaching Grade 6 mathematics are chalkboard/projector presentation and demonstrations with concrete materials, followed by assigned exercises. The majority of teachers also frequently have the students themselves use concrete materials when studying geometry and measurement. Most teachers do not use calculators or computers to teach mathematics.

Most students spend some time every day on mathematics homework. Fifty-eight per cent spend half an hour or less, and 21 per cent spend more than half an hour. Sixty-three per cent of the students receive help with mathematics from family members.

#### How will the results of the review be used?

The individual schools and school boards involved in the review have been provided with their results and will interpret them and make recommendations for program improvement. Each board will submit a report to the Ministry of Education outlining how the results were used.

The provincial results have been provided to the committees currently working on program changes for elementary schools. This detailed information will assist in the specification of instructional strategies and the selection of resources. Steps will be taken to reinforce the many positive aspects of the mathematics program that have been identified and to ensure that procedures are implemented to improve areas of weakness. Future ministry guidelines should provide specific policies on the role of calculators and computers in mathematics instruction and on strategies for teaching students to solve non-routine problems. Methods and resources for teaching measurement and geometry will also be reviewed.

#### Answers to Questions

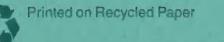
1. a
2. 0.666
3. b
4. b
5. d
6. d
7. c



There are three other correct solutions to this question.

10. 34

11. 13 cents



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# MATHEMATICS

## Grade 6

A REPORT CARD FOR ONTARIO



Ministry  
of  
Education



# MATHEMATICS

## Grade 6



### Sample Questions From the Review

Selected questions from the Grade 6 mathematics review are reproduced below. Three boxes appear under each of the first nine questions. From left to right, they contain the following data:

1. the percentage of students who answered the question correctly;
2. the percentage of teachers who indicated that students had had the opportunity to learn the material or acquire the skills needed to answer the question;
3. the percentage of students that teachers predicted would answer the question correctly.

The panel rating is also given for each question.

1. Which of these represents eight hundred seven and three tenths?

- a)  $807.3$
- b)  $87.3$
- c)  $8073$
- d)  $873$

**85** **100** **75**

Panel rating: strong

This question on numeration measures students' understanding of decimal notation and their ability to read numbers.

$$2. \frac{66.6}{100} = \underline{\hspace{2cm}}$$

- [26] **92** **60**

Panel rating: weak

The ability to divide by 100 is an important skill in converting units in the metric system.

### Introduction

Provincial reviews form part of the Ministry of Education's ongoing commitment to the monitoring of programs in schools. The results inform the public about the performance of education programs in Ontario and provide information to schools, school boards, and the Ministry of Education to assist in the improvement of programs.

A provincial review of mathematics was conducted in selected Grade 6 classes in Ontario during the spring of 1988. The main questions answered by the review were "How well are Grade 6 students achieving the goals of the mathematics curriculum?" and "How are Grade 6 students taught mathematics?" Highlights of the results are summarized below.

### Highlights

- Grade 6 students in Ontario are achieving at levels judged to be satisfactory or better for the majority of topics in mathematics.
- Student achievement is particularly strong in the following areas: dealing with data presented in tables and graphs; addition, subtraction, multiplication, and division of whole numbers; and three-dimensional geometry.
- Student achievement is satisfactory in the following areas: addition, subtraction, multiplication, and division of decimals and fractions; applying these operations to solving word problems; understanding place value and the meaning of numbers; measurement of length; and two-dimensional geometry.

The following were identified as areas of concern, where improved performance would be desirable: measurement of area, volume, and mass; understanding concepts in geometry; understanding the motion of figures in the plane; and applying problem-solving strategies to non-routine problems.

- The majority of students feel that mathematics is important, that they are good at mathematics, and that they like studying mathematics.
- The most commonly used methods for teaching mathematics are chalkboard/projector presentation and demonstrations with concrete materials, followed by assigned exercises.

■ Most teachers do not use calculators or computers to teach mathematics.

■ Seventy-nine per cent of the students do some mathematics homework, and 63 per cent of the students receive help with mathematics from someone at home.

3. Four train tickets cost \$68.60. How much does each ticket cost?  
  - a) \$17.60
  - b) \$17.15
  - c) \$17.14
  - d) \$17.50

**81** **98** **77**

Panel rating: satisfactory

This word problem requires division.

4. In the second year, which month shows the highest number of enquiries?



- a) February
- b) March
- c) April
- d) May

**96** **88** **75**

Panel rating: superior

This question on the topic of representation requires students to read data from a graph and compare values.

5.  $70 \text{ m}^3$  could be the volume of:

- a) a box of oranges
- b) a washing machine
- c) a loaf of bread
- d) a living room

**59** **75** **48**

Panel rating: marginal

This is a question on measurement that requires students to estimate volume in metric units.

### How was the review conducted?

Information was collected from students, teachers, and principals through the use of questionnaires and mathematics test questions. The data in this report card are based on a provincial sample of 100 English-language schools (approximately 4400 students and 220 teachers). In addition to the provincial sample, 61 boards chose to have all their English-language schools participate in the review process by conducting board reviews in a manner identical to that of the provincial review.

A detailed presentation of all results for this review is contained in the *Report for Educators*. Participating schools and school boards have received reports containing local results. A provincial review was also conducted in French-language schools, and parallel reports are available in French.

### What types of questions were students asked?

Most of the questions in the student booklets were multiple-choice questions, to which students responded by choosing the correct answer from four possible responses. Some questions required a written response, such as a numerical answer, a diagram, a complete solution to a problem, or a complete graph. Students were also presented with a set of oral questions that they had to answer without the aid of pencil-and-paper calculations. In addition, teachers evaluated student performance in a set of practical tasks requiring the use of concrete materials.

The assessment questions covered the following areas of the mathematics curriculum:

#### 1. Arithmetic:

- numeration (place value and the meaning of numbers)
- operations (addition, subtraction, multiplication, and division of whole numbers, decimals, and fractions; applying these operations to solve word problems)
- representation (interpreting and developing graphs, charts, and maps)

#### 2. Measurement:

- length
- area
- volume
- mass

#### 3. Geometry:

- two-dimensional geometry
- three-dimensional geometry
- understanding terms and concepts in geometry
- the motion of figures in the plane

#### 4. Non-routine problems:

- applying problem-solving strategies to unfamiliar problems

The questions were designed to assess three cognitive levels: *skill*, *understanding*, and *application*. Skill questions required the use of standard procedures and routine manipulations. Students demonstrated understanding through interpretation, association of ideas, and recognition of relationships. They were also required to apply strategies and concepts to new situations.

Selected questions from the assessment booklets are presented in the margins of this report card.

6. Which square has the same perimeter as this figure?



- a) 2.5 cm
- b) 3.5 cm
- c) 3 cm
- d) 4 cm

**75** **95** **67**

Panel rating: satisfactory

This is a question on measurement of length that requires students to compute the perimeter of a square and of an irregular figure.

- If these two figures are congruent, side FG is the same length as:



- a) side NM
- b) side ML
- c) side LK
- d) side KN

**85** **74** **62**

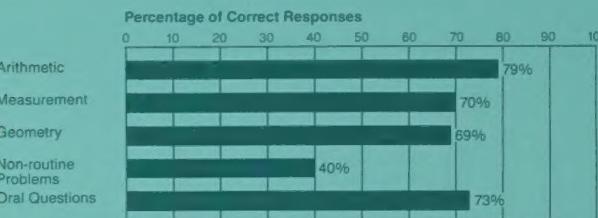
Panel rating: strong

This question on concepts in geometry measures students' understanding of congruency.

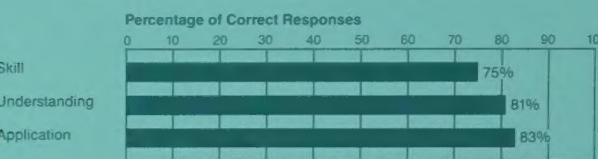
### How well did students perform?

The average percentages of correct responses to questions in the main areas of the mathematics curriculum are presented in the graphs below.

#### Summary of Student Achievement in Mathematics



#### Student Achievement in Arithmetic by Cognitive Level



It should be noted that many of the questions measuring application were word problems. The 83 per cent average in this category indicates that students were able to answer this type of question with little difficulty.

Results are broken down by cognitive level for only arithmetic, because it was only for this area of the mathematics curriculum that there were a significant number of questions testing all three cognitive levels. The measurement questions primarily assessed understanding and application, most of the geometry questions tested understanding, and the non-routine problems assessed application exclusively.

The graphs that follow show the percentages of correct responses for the specific topics within arithmetic, measurement, and geometry.

#### Student Achievement in Arithmetic by Topic

